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ENVIRONMENT AND SUSTAINABLE DEVELOPMENT

In the earlier lessons, you have learnt about economic development and how it can improve the quality of life of people. Goods and services are produced to satisfy human wants. The production of various goods and services requires resources- both man-made and natural. As more goods are produced, more resources are used up. The process of production not only uses up resources, but also causes other problems. For example, when goods are produced in factories, the factories emit smoke which pollutes the air we breathe. Similarly, sewage discharged into rivers pollutes our drinking water. As the demand for goods and services keeps increasing, so does the demand for resources. As a result, resources are getting depleted and also being damaged irreparably. As we cut down forests, pollute the air and rivers, and mine minerals from the earth, we destroy nature. Such a destruction of nature is adversely affecting human life.



OBJECTIVES

After completing this lesson, you will be able to:

- *know the definition and significance of environment;*
- *understand the various environmental problems such as pollution, degradation, depletion of resources;*
- *explain the meaning of sustainable development;*
- *tell the ways to achieve sustainable development.*

23.1 THE ENVIRONMENT: DEFINITION AND SIGNIFICANCE

The **environment** encompasses all living and non-living things occurring naturally on Earth or some region thereof. It includes all the biotic and abiotic factors that



influence each other in nature. All the living elements like birds, animals, plants, forests, etc. comprise the **biotic** elements. On the other hand, everything non-living like air, water, rocks, sun, etc. are examples of the **abiotic** component of the environment. A study of the environment is thus a study of the inter-relationship between the abiotic and the biotic components of the environment.

Significance of the Environment

1. The environment provides various resources to man-both renewable and non-renewable. Renewable resources are those resources which are replenished easily over time, and hence can be used without the possibility of the resource becoming depleted or exhausted. Examples of **renewable** resources include trees in the forests, fishes in the ocean, etc. **Non-renewable** resources, on the other hand, are those resources which can get exhausted or depleted over time as they are used up. Examples of non-renewable resources include fossil fuels and minerals like petroleum, natural gas, coal, etc. Thus these resources need to be used carefully, while keeping in mind the requirements of the future generations.

Do you know?

Based on current projections, within around 50- 75 years, all the world's extractable coal, oil, natural gas, and uranium-235 deposits- that is, all our current energy sources-would have been used up.

2. The environment is also an absorber of harmful wastes and byproducts, that is, it assimilates waste products. The smoke from chimneys and exhaust pipes of vehicles, sewage from cities and towns, industrial effluents are all absorbed by the environment. These harmful wastes and byproducts are absorbed, cleaned and recycled by various natural processes.
3. The environment also sustains life by providing bio diversity. The genetic variations created by the pressures exerted by the environment on various life forms allows those life forms to adapt, evolve and produce genetic variations which can survive in harsh environments. Hence the environment produces and maintains relationships between different life forms and the abiotic components and sustains life. It is therefore important to preserve these life forms by preserving the environment.
4. Apart from the biological significance of the environment, the environment is also important from the aesthetic point of view. It provides scenery and landscapes to us which are priceless to us, and often play an important role in man's culture around the world.



INTEXT QUESTIONS 23.1

1. What is meant by 'environment'?
2. Name two main components of environment.
3. Name two renewable and two non-renewable resources.



Notes

23.2 ENVIRONMENTAL PROBLEMS

With the advance of human civilization, human wants have expanded and diversified. This has led to a rapid depletion of natural resources. Many resources are being used up at a rapid rate, which has caused over-utilization and depletion of many resources. With the rapid use of resources, a lot of accompanying environmental problems has cropped up. These include pollution of air and water, degradation of natural resources like soil and forests, and the depletion of non-renewable resources like fossil fuels and minerals. In the sections below you will read about these environmental problems and understand the significance of their impact on the economy and the planet earth.

23.2.1 Pollution

The term **pollution** refers to an undesirable change in the quality of a natural resource or the natural ecosystem. The change may be harmful to life immediately or over a long period of time. Thus, pollution adversely affects the health of living beings.

Pollution is caused by a pollutant. A **pollutant** is a waste material or substance which causes an undesirable change in a natural resource or ecosystem. Smoke, dust and poisonous gases in the atmosphere and industrial effluents and sewage from cities in water are some common examples of pollutants. Further, human activities also generate heat and create noise or harm living beings in a multitude of other ways.

23.2.1.1 Air pollution

Air pollution is the introduction of chemicals, particulate matter, or biological materials that cause harm or discomfort to humans or other living organisms, or cause damage to the natural environment or built environment, into the atmosphere. Major air pollutants include sulphur oxides, nitrogen oxides, carbon monoxide, carbon dioxide (which is also a major greenhouse gas), toxic metals, and particulate matter.

Do you know?

The World Health Organization states that 2.4 million people die each year from causes directly attributable to air pollution. Worldwide more deaths per year are linked to air pollution than to automobile accidents.



Effects of air pollution:

The health effects caused by air pollution may include difficulty in breathing, wheezing, coughing and aggravation of existing respiratory and cardiac conditions. These effects can result in increased medication, increased doctor or emergency room visits, more hospital admissions and premature death.

Sources of Air Pollution

Major **artificial sources** (caused by human beings) of air pollution include:

- Smoke from power plants, factories, incinerators, furnaces, etc.
- Exhaust of vehicles and automobiles like cars, buses, bikes, airplanes, ships, etc.
- Chemicals like pesticides and fertilizers and dust from farming and other agricultural practices.
- Fumes from paint, hair spray, varnish, aerosol sprays and other solvents.
- Waste deposition in landfills, which generates methane, which also contributes to global warming.

Major **natural sources** of air pollution include:

- Dust from natural sources, usually barren land.
- Methane, emitted by the digestion of food by animals, for example cattle.
- Smoke, particulate matter and carbon monoxide from wildfires.
- Volcanic activity, which produce sulphur, chlorine, and ash particulates.

23.2.1.2 Water pollution

Water pollution is the contamination of water bodies (example lakes, rivers, oceans and groundwater) by pollutants discharged directly or indirectly into water bodies without adequate treatment to remove harmful compounds. Major sources of water pollution include industrial chemicals and effluents, nutrients, waste water, sewage, etc.

Effects of water pollution:

A number of waterborne diseases such as cholera, typhoid, diarrhea etc. are produced by the pathogens present in polluted water, affecting human beings and animals alike. Water Pollution affects the chemistry of water. The pollutants, including toxic chemicals can alter the acidity, conductivity and temperature of water. It also kills life that inhabits water-based ecosystems like fish, birds, plants, etc. and hence disturbs the natural food-cycle, which causes instability in ecosystems.



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Sources of Water Pollution

Major **sources** of water pollution include:

- Discharge from sewage treatment plants and sewage pipes from cities and towns.
- Industrial effluents released by factories into water bodies.
- Chemicals like pesticides and fertilizers from agricultural farms which constitute runoff from farms.
- Contaminated storm water from storm water drains in cities.
- Release of heated or radioactive water by power plants into water.
- Oil spills and leakages from tankers and oil rigs.
- Growth of algae in water bodies.

23.2.1.3 Noise pollution

Noise pollution is an excessive and displeasing environmental noise that disrupts the activity or balance of human or animal life.

Effects of noise pollution:

Noise pollution in the form of unwanted sound can damage physiological and psychological health. Noise pollution can cause annoyance and aggression, hypertension, high stress levels, hearing loss, sleep disturbances, and other harmful effects. Chronic exposure to noise may cause noise-induced hearing loss. People exposed to significant occupational noise demonstrate significantly reduced hearing sensitivity compared to non-exposed people. High and moderately-high noise levels can contribute to cardiovascular effects, a rise in blood pressure, and an increase in stress thus affecting the physical and mental health of people.

Sources of Noise Pollution

Major **sources** of noise pollution include:

- Vehicular traffic, like cars, buses, airplanes, trains etc.
- Industrial processes like stone crushing, making of steel plates, sawing, printing, etc.
- Construction work on roads, bridges, buildings, etc.
- Various noises from houses like stereos, televisions, etc.
- Consumer products like air conditioners, refrigerators, etc.



Notes

In the above section you have read about different types of pollution, their sources and effects. Think of different kinds of pollution which affect you and your family and make a list of them. What are the measures you or your family and community can take to reduce the harmful effects of pollution?



INTEXT QUESTIONS 23.2

1. What is a pollutant?
2. Name any two sources of air pollution.
3. Name two harmful affects of water pollution.
4. What is meant by noise pollution?

23.2.2 Degradation

In the following sections you will read about two different kinds of degradation- soil and habitat degradation.

23.2.2.1 Soil degradation

Soil degradation refers to an undesirable or deleterious change or disturbance in the quality of the soil. It leads to a change in the species of plants and animals in an area, and often leads to a loss of quality and productivity of the soil in an area. The soil loses its natural nutrients, minerals and organic matter (known as **humus**) and disrupts the natural balance of the natural ecosystem. The soil hence becomes unfit or unsuitable for growing plants and crops.

Causes of Soil Degradation

Major **causes** of soil degradation include:

- Excessive use of chemical fertilizers and pesticides, which causes soil acidification, increases salinity and alkalinity of the soil, reduces organic matter, and increases levels of organic pollutants and toxins and heavy metals (like Cadmium, Lead, etc.).
- Waterlogging caused by excessive irrigation and failure to subsequently drain the water from the fields causes an increase in salt content of the soil, making it unfit for growing plants, as well as serves as a breeding ground for mosquitos.
- Overgrazing by animals in fields, which reduces plant cover and leaves the soil prone to erosion.



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Do you know?

Damage from soil erosion worldwide is estimated to be \$400 billion per year (around Rs 20 lakh crores per year). As a result of erosion over the past 40 years, 30 percent of the world's arable land has become unproductive.

Effects of soil degradation

Soil degradation can significantly reduce the yield potential of soil for growing crops. The presence of pollutants in soil also leads to pollution of groundwater, which has increased levels of nutrients, organic toxins, and heavy metals. Also, degradation of soil causes the soil to lose its green cover, and hence reduces biodiversity in that region, as the growth of plants in an area is essential for animals to survive and for the food chain to function normally. This also leads to extinction of plant and animal species. Soil degradation also leads to desertification, that is, the land gradually gets converted into a desert which becomes unfit for cultivation or habitation.

23.2.2.2 Habitat degradation

Habitat degradation refers to the process in which habitats lose their normal functioning or quality to support native life due to human activities. Habitat degradation leads to a reduced **carrying capacity** of that area, that is, the number of animals or plants of a particular species the area can support. This leads to a reduced population of various species in that area (or habitat) which in turn leads to an imbalance in the natural food chain and ecosystem. This imbalance can lead to the mass extinction of many plants and animals on our planet.

Causes of Habitat Degradation

Major **causes** of habitat degradation:

- Deforestation and wood extraction for the timber industry.
- Conversion of forest land into agricultural land
- Urban expansion of natural habitats
- Soil erosion and desertification, which can lead to whole forests degenerating into deserts.
- Slashing or slash-and-burn agricultural methods, where forests are burnt and crops grown using the ashes as a natural fertilizer.

Effects of habitat degradation:

Habitat destruction vastly increases an area's vulnerability to natural disasters like flood and drought, crop failure, spread of disease, and water contamination. Agricultural land too suffers from the destruction of the surrounding landscape.



Over the past 50 years, the destruction of habitat surrounding agricultural land has degraded approximately 40% of agricultural land worldwide through erosion, nutrient depletion, pollution, etc. Habitat degradation has also led to the loss of many valuable ecosystem services like the nitrogen, phosphorus, sulphur and carbon cycles, which in turn has increased the frequency and severity of acid rain, algal blooms, and fish kills in rivers and oceans and contributed tremendously to global climate change. It also leads to loss of biodiversity and species extinction, which upsets the natural balance and may alter the ecosystem. Aesthetic uses such as bird watching, recreational uses like hunting and fishing, and ecotourism are also affected adversely by habitat degradation, as most of them rely upon virtually undisturbed habitat.

Do you know?

If the current rate of deforestation continues, there will only be 10% of the world's tropical forests left by 2030, and another 10% in a degraded state.

23.2.3 Depletion of Resources

Resource depletion is an economic term referring to the exhaustion of raw materials in an area or region. Resource depletion is most commonly used in reference to farming, fishing and mining. Today's economy is largely based on fossil fuels, minerals and oil. The value of these resources has increased over time as demand for them has increased rapidly, while at the same time the supplies of these resources have decreased considerably due to over-exploitation.

Many resources which are so essential in our lives—example petroleum, natural gas, coal, uranium-235, and gold are becoming increasingly difficult to find. The reserves of many natural resources have been diminishing rapidly in the last 100-150 years, as the human population has been increasing significantly and hence the demand for the resources has been increasing. The search for new reserves of these resources is expensive, and often does not yield any new mines. The earth is quickly running out of resources, as we are putting too large a burden on it, caused due to overpopulation.

Alongside the depletion of the resources, many environmental effects are also caused by the over-exploitation of mineral resources. Global warming, air, water and soil pollution, loss of biodiversity all accompany mining and drilling projects and extraction and purification procedures for these resources.

To stop the harmful effects of resource depletion and other environmental problems, we need to carefully monitor resources usage and check the environmental effects of resource depletion. Many agencies around the world like UNEP (United Nations Environment Programme), EPA (Environment Protection Agency), IPCC (Intergovernmental Panel on Climate Change), and in India the MEF (Ministry of Environment and Forests) along with many NGOs worldwide actively advocate the



protection of the environment throughout the world, and implement acts and laws to protect the environment and prevent the overexploitation of resources.

The careful usage of the limited resources available to human beings, which is now being advocated as an essential solution to the worldwide environmental crisis that threatens our very existence, is also referred to as **sustainable development**, which is explained in detail along with its significance in the following pages of this chapter.



INTEXT QUESTIONS 23.3

1. What is meant by degradation of soil.
2. What are two different kinds of degradation of environment?

23.3 SUSTAINABLE DEVELOPMENT

Sustainable Development is a pattern of resource use that aims to meet human needs while preserving the environment so that these needs can be met not only in the present, but also for generations to come. Sustainable development has been defined in many ways, but the most frequently quoted definition is from *Our Common Future*, also known as the *Brundtland Report*. According to this definition, “Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.”

This definition emphasizes two important things. One, that natural resources are vital to every one of us- even to the unborn future generations. Two, that it is a long term concept. It does not narrowly focus only on the present economic growth but it also takes into account the future economic growth.

In the above section you have read about different resources like air, water, minerals etc. which are essential to meet our needs. If we pollute the air and water sources and deplete the non-renewable resources like coal, petroleum, natural gas etc. then future generations would suffer. The concept of sustainable development therefore emphasizes that we have no right to deny the right to life to future generations. The world’s stock of resources is not only meant for present generation but also for future generations. That is why it is our responsibility to use the environment judiciously to meet our needs of today, then bequeath them to our children and grandchildren (the future generations) so that they are able to meet their own needs as well.

Sustainable development, is, therefore, a kind of development that takes into account the needs of the economy, and the environment without compromising either of the aspects. If the economic development is **sustainable** then the present use of natural resources will not limit us from their use in the future. Thus sustainable development tells us that development must be of a kind which can take care of our needs as well as the needs of future generations. That makes it a long term concept.



23.4 HOW CAN WE ACHIEVE SUSTAINABLE DEVELOPMENT?

In this chapter we have learnt about how the growth of population and mankind's quest for economic development and a better quality of life in the last two centuries has caused a lot of problems to our environment and the planet earth. The problems we focused on were pollution, degradation and depletion of resources.

We also learnt about the meaning of sustainable development and how important it is to keep in mind the development and wellbeing of future generations. But how do we **achieve** sustainable development? The environmental crisis we face is serious and pressing. However, by taking swift and decisive action, we can tide over the crisis.

All definitions of sustainable development require that we see the world as a whole. You have already understood that the concept of sustainable development is a long-term concept that gives equal importance to development of future generations also. Sustainable development also emphasizes that actions and measures taken in one part of the world has consequences for people in other parts of the world. For development to be sustainable we must think of development not only for our community or village or country but for the world as a whole. To give an example, if factories emit smoke in North America, then that air pollution from North America affects air quality in Asia. Similarly, pesticides sprayed in Bangladesh could harm fish stocks off the coast of West Bengal.

Measures for sustainable development therefore focus on policies that must be adopted in the whole world. Some of these policies are implemented at the level of governments of individual countries while others require coordination at the international level.

Some examples of ways in which we can contribute to sustainable development are given below.

- **Resources-** finding substitutes for nonrenewable resources and using renewable resources judiciously. Solar energy, wind energy, hydropower, tidal energy and biofuels (like gobar gas) are being widely and increasingly used as substitutes for energy sources like coal, oil and natural gas that are being depleted rapidly. In many villages of India, solar energy appliances like solar cookers, solar lanterns and solar heaters are being encouraged and promoted by the government. In coastal areas the wind energy harnessed by windmills is being used to generate electricity.
- **Recycling -** to use again, to re-process. To make paper we need wood pulp which comes from trees. Therefore by recycling used paper we can contribute to saving trees from being cut down. Water is a scarce resource yet we do not use water judiciously. We can reuse rainwater by rainwater harvesting.



Notes

- **Reduce** - to use less or economize. Our consumption should be restrained to meeting our basic needs. We can walk instead of driving to the local market or climb using stairs instead of taking a lift, switch off fans and lights that we don't need.

As an exercise, consider how you could promote sustainable development in your local community. What can you do to improve your local environment? Write down how your actions can help improve the environment and the lives of people who live in other parts of the world.



INTEXT QUESTIONS 23.4

1. What do you mean by sustainable development?
2. Give one example of recycling of products for sustainable development of the environment.



WHAT YOU HAVE LEARNT

- The environment includes all the biotic and abiotic factors that influence each other in nature.
- Resources may be renewable like forests, and non-renewable like petroleum.
- Pollution is an undesirable change in the quality of a natural resource or natural eco-system.
- Air pollution causes difficulty in breathing, coughing etc. water pollution causes water borne diseases like cholera, typhoid, diarrhea etc.
- Noise pollution can cause hypertension, hearing loss, etc.
- Soil degradation reduces the yield potential of soil for growing crops.
- Resource depletion refers to the exhaustion of raw material in an area or region.
- Sustainable development is a development that meets the needs of the present without compromising the ability of future generations to meet their own needs.
- We can contribute to sustainable development
 - (i) By finding substitute for non-renewable resources and using renewable resources judiciously.
 - (ii) By recycling the used products
 - (iii) By restraining our consumption.

**TERMINAL EXERCISE**

1. Distinguish between renewable and non-renewable resources. Give at least two examples of each.
2. With the advance of human civilization many environmental problems have cropped up. Do you agree? Give reasons for your answer.
3. What is meant by air pollution. Name any three major sources of air pollution. What are its harmful effects?
4. What is water pollution? Mention major sources of water pollution. What are its harmful effects.
5. What is noise pollution? Name its major sources. Describe its harmful effects.
6. What is meant by soil degradation? What are its major causes? Write two harmful effects of soil degradation.
7. What do you mean by habitat degradation? Mention its major causes. What are harmful effects of habitat degradation?
8. What is meant by depletion of resources? Give two examples of resources whose reserves have been diminishing rapidly in the last 100-150 years.
9. What is meant by sustainable development? Suggest two ways by which we can contribute to sustainable development.

**ANSWERS TO INTEXT QUESTIONS****Intext Questions 23.1**

1. The environment encompasses all living and non-living things occurring naturally on earth or some region thereof.
2. (i) Biotic element (ii) Abiotic elements
3. Renewable resources: Forest, water
Non-renewable : Petroleum, coal

Intext Questions 23.2

1. A pollutant is waste material or substance which causes an undesirable change in natural resource or eco-system.



2. (i) smoke from factories
(ii) Exhaust of automobiles
3. (i) Causes diseases like cholera, typhoid etc.
(ii) kills aquatic life
4. Excessive and displeasing environmental noise that disrupts the activity or balance of humans and animal life, is noise pollution.

Intext Questions 23.3

1. Soil degradation refers to a undesirable or deleberious change or disturbance in the quality of soil.
2. (i) Soil degradation
(ii) Habitat degradation

Intext Questions 23.4

1. Sustainable development is a pattern of resource use that aims to meet human needs with preserving the environment so that these needs can be met not only in the present, but also for generations to come.
2. We can reuse rain water by rain water harvesting